Oral Expositions

2 - Vascular Neuro Imaging Developments

0019
Spontaneous Unruptured Intracranial Arterial Dissecting Aneurysms: High Resolution Magnetic Resonance Imaging at 3.0T

YX Li

TianTan Hospital, BeiJing, China.

Background: 3.0T MRI can characterize arterial pathology, but limited studies have applied this technique to evaluate spontaneous unruptured intracranial arterial dissecting aneurysms (IADAs).

Objective: To improve diagnostic accuracy and to make clinicopathological classifications of this disorder by using 3.0T MRI combined with DSA.

Methods: 68 consecutive patients were imaged with two 3.0T MRI scanners. Wall imaging findings and angiography patterns were carefully analyzed. Lesions were categorized according to classifications proposed by Mizutani et al. Chi-square and Fisher exact tests were used for statistical analyses.

Results: Imaging of 57 patients with 68 IADAs were qualified for further analysis. Detecting rate of double lumen, intramural hematoma (IMH) and intimal flap was 67.6%, 58.8% and 39.7% respectively. IADAs mostly presented as fusiform dilation (37 of 68, 54.4%) on angiography. But IMHs mostly featured in dilation-with-stenosis pattern (13 of 16, 81.3%). 92.3% (12 of 13) of type 3 dolichoectatic dissecting aneurysms were featured with IMH, followed by type 1 classical dissecting aneurysms (27 of 37, 73.0%). *Results:* of double lumen and IMH showed difference in dilated patterns or different clinicopathological types ($P < 0.05$).

Conclusion: 3.0T high resolution MRI demonstrated higher detection rate of pathognomonic findings in patients with unruptured IADAs. This technique made it possible to understand primary etiology of different angiography patterns, highly useful for determining confident diagnosis and clinicopathological classifications. It also offered further exploration into pathomechnisms of IADAs.

0114
Evaluation of Histological Components in Carotid Plaque with Color Plaque Image: Non-Gated MRI Versus IB-IVUS

M Hayashi[1], S Iwabuchi[1], K Sato[1], T Yokouchi[2], K Aoki[1], H Nakayama[1], N Saito[1], J Harashina[1], J Iwama[1], M Ishii[1], Y Iizuka[3], T Gomi[3]

[1] Department of Neurosurgery, Toho University Ohashi Medical Center, Japan. [2] Department of Neurosurgery, Yokohama general hospital, Japan. [3] Department of Radiology, Toho University Ohashi Medical Center, Japan

Purpose: When carotid artery stenting (CAS) is performed for the patients with carotid artery stenosis, we need to have accurate evaluation of plaque histology to ensure a safe procedure. Various radiologic and physiologic techniques are used in plaque assessment. In this study, we constructed the color image of carotid plaque using non-gated MR imaging and integrated backscatter intravascular ultrasound (IB-IVUS) in the patients undergoing CAS and evaluated carotid plaque histology.

Materials and Methods: Between January 2012 and Spring 2013, 18 patients were assessed carotid plaque histology with non-gated MR imaging and IB-IVUS. As MR plaque imaging, T1 weighted imaging with non-gated spin echo before CAS was obtained. On the basis of the data, color plaque images by components (Hemorrhage, Lipid and Fibrous) were constructed with proprietary software. IVUS image were taken during CAS. The color plaque image was generated by IB values obtained from IVUS RF data, with custom software. Then color plaque images by both examinations were compared.

Results: All patients were obtained good color plaque images. Comparing color plaque imaging between MRI and IVUS, both plaque images were mostly matched for the location of vulnerable plaque (hemorrhage and lipid component). However, it was difficult to evaluate carotid plaque with heavy calcification, because non-gated MRI is unable to detect calcification and IB-IVUS is unable to evaluate the plaque beyond calcification.

Conclusion: Non-gated MRI and IB-IVUS were useful to identify vulnerable plaque. It may lead to safe CAS procedure to better understand of plaque histology and characteristics of these two examinations.

0115
Feasibility Study of Using Syngo Iflow for Whole Brain Perfusion Imaging Assessment with Intra-Arterial Contrast Media Injection Protocol

Q Zhang[1], RX Xu[1], B Wang[1], Q Sun[2], H Zhang[1], TH Shan[1], Y Deuerling-Zheng[3], M Kowarschik[3], J Beilner[2]

[1] Beijing PLA Military General Hospital Affiliated Bayi Brain Hospital, China. [2] Siemens Ltd., China, China. [3] Siemens AG, Germany

Purpose: Intra-arterial cerebral blood volume acquired with flat-detector angiographic systems (IAFD-

CBV, syngo DynaPBV Neuro, Siemens, Germany), with minimum contrast media (CM) usage, provided valuable quantitative brain functional information. Due to individual variations of vasculature at aortic arch causing non-uniform CM distribution, asymmetric perfusion existed for certain patients without cerebral circulatory disorders.

This work aims at testing the feasibility of using color-coded quantitative digital subtracted angiography (CCQ-DSA, syngo iFlow, Siemens, Germany) to predict perfusion symmetry.

Materials and Methods: CCQ-DSA at aortic arch and IAFD-CBV were acquired for 11 patients without perfusion-related cerebral abnormities. In CCQ-DSA, regions of interest (ROI) were defined on bilateral carotid arties (CA). Time intensity curves (TIC) were extracted and area under curves (AUC) were calculated. To evaluate the symmetry of brain perfusion, ROI were defined on bi-frontal lobes and basal ganglia in CBV maps.

Results: Seven patients demonstrated good perfusion symmetry for left/right hemisphere with relative CBV 1.00+/–0.02 (1.00 for perfect symmetry). Relative AUC from bilateral CA in CCQ-DSA was found to be 0.97+/–0.04. For the other 4 patients, CBV from right hemisphere was significantly higher than those from the left with relative CBV 0.78+/–0.03. This asymmetric perfusion was confirmed by the CCQ-DSA with relative AUC 0.82+/–0.11.

Conclusion: This study showed good correlation between AUC of TICs at CA and CBV maps. CCQ-DSA potentially help to sort out patients whose vascular anatomy could support for symmetric perfusion and suitable for IAFD-CBV acquisitions.

0121
Time Resolved Whole Brain Perfusion Imaging within the Angio Suite: Preliminary Results of a Novel Flat-Detector CT Application in Comparison to Conventional CT/MR Perfusion Imaging

T Struffert[1], T Engelhorn[1], S Kloska[1], Y Deuerling-Zheng[2], C Strother[3], P Goelitz[1], S Lang[1], A Mennecke[1], A Doerfler[1]

[1] University of Erlangen-Nuremberg, Department of Neuroradiology, Germany. 2 Siemens AG, Healthcare Sector, Forchheim, Germany. [3] University of Wisconsin, Department of Radiology, United States of America.

Purpose: The aim was to evaluate time resolved whole brain perfusion imaging (cerebral blood flow and volume (CBF, CBV), mean transit time (MTT) and time to peak (TTP)) using a novel high-speed FD-CT acquisition in conjunction with a single intravenous injection of contrast in comparison to conventional perfusion imaging (CT, MR).

Methods: Under an institutionally approved protocol the new FD-CT application (Siemens Axiom Artis dBA) was used in 12 patients with acute stroke (M1 occlusion).

Measurements were made following endovascular treatment. Using prototype software calculation of CBF, CBV, MTT and TTP maps was possible using a deconvolution-based algorithm. Within 4 hours after treatment all patients were evaluated by CT or MR perfusion imaging. Parameter maps were reviewed independently by two experienced neuroradiologists using the ASPECTS score.

Results: Seven female and 5 male patients (mean 72 years) with M1 occlusions (7 left, 5 right) were included. Recanalzation succeeded in 6 (TICI=3) and failed in another 6 patients (TICI=0). Pearson's correlation coefficient comparing ASPECTS values of perfusion parameters between FD-CT and conventional modalities was high for both reviewers (REV 1: CBV 0.49, CBF 0.97, MTT 0.96, TTP 0.96; REV 2: CBV 0.4, CBF 0.98, MTT 0.95, TTP 0.97). Inter-reviewer correlation of the FD-CT (CBV 0.59, CBF 0.87, MTT 0.94, TTP 0.99) and conventional maps (CBV 0.93, CBF 0.96, MTT 0.99, TTP 0.91) was also in a high range.

Conclusion: Time resolved whole brain perfusion imaging within the angio suite is feasible. Qualitative evaluation of FD-CT parameter maps using ASPECTS indicated a high correlation to those obtained by standard perfusion imaging.

0130
Effective Patient Dose of Flat-Detector CT and Multislice CT Protocols: Comparative Measurements Using the Alderson Rando Phantom

T Struffert[1], M Hauer[1], R Banckwitz[2], C Koehler[2], A Doerfler[1]

[1] University of Erlangen-Nuremberg, Department of Neuroradiology, Germany. [2] Siemens AG, Healthcare Sector, Forchheim, Germany

Purpose: Increasingly, flat detector CT (FD-CT) is used for various applications in neuroradiology, such as brain visualization, intravenous FD-CT angiography, FD-CT perfusion or petrous bone scanning, respectively. Additionally, intraarterial 3-D-DSA is used to supplement 2-D angiographic (DSA) studies. However, effective patient dose has not been sufficiently addressed in these new applications. The aim was to measure and compare the dose of 1) analogue FD-CT and multislice CT (MSCT) protocols and 2) standard 2-D DSA to intraarterial 3-D DSA.

Materials and Methods: Using an Alderson Rando phantom effective patient dose (according to ICRP 103) was measured on a 128 row multislice CT (Siemens Somatom AS +) and a flat detector angiographic system (Siemens Axiom Artis dBA) using standard protocols as recommended by the manufacturer.

Results: 1) Comparison of FD-CT and MSCT (FD-CT/MS-CT): brain parenchyma imaging 2.9 vs 1.4 mSv, perfusion imaging 2.3 vs 4.2 mSv, petrous bone 0.4 vs 0.2 mSv, angiography head using collimators 0.5 vs 0.5 mSv, respectively.

2) 2-D DSA protocols: ap.-lat. standard series 1 mSv, enlarged oblique projection 0.3 mSv, intra-arterial 3-D DSA 0.9 mSv (using collimators 0.3 mSv), respectively.

Conclusions: The effective dose of a brain FD-CT is twice as high as for a MSCT, whereas other FD-CT applications are in the dose range of MSCT. Using collimation for these FD-CT applications, the dose may be reduced considerably up to 70%. Especially due to the

low dose of 3-D DSA, we recommend to use this technique primarily for visualization of aneurysms in order to reduce the number of 2-D DSA series to identify the ideal working position for endovascular therapy.

0131
Real-Time Dosimetry During Neuro-Angiography: First Experience with the Raysafe I2 System

T Struffert[1], M Feifel[2], A Doerfler[1]

[1] University of Erlangen-Nuremberg, Department of Neuroradiology, Germany. [2] Unfors RaySafe GmbH, Ulm, Germany.

Purpose: During angiography, the staff is monitored by film badges with the disadvantage that the dose is released retrospectively. A real time personal measurement and visualization is desirable to recognize increased exposure and optimize radiation protection during an angiography.

Materials and Methods: The RaySafe i2 system was used during 30 angiographic investigations. Series of the cervical carotid artery, ap.-lat. standard projection (FoV 32 cm), bi- and mono-plane magnified (FoV 16 cm) and 3-D DSA were obtained. Data was transferred wirelessly to the real time in-room display. Using RaySafe i2 dose viewer software the mean values of the peaks of the dose rates (mSv/h) of the different series were calculated.

Results: The following dose rates (mSv/h) were measured:

1. cervical carotid artery (n=24), mean 0.12 +/– 0,08
2. ap.-lat. standard projection (n=76), mean 0,9 +/– 0,9
3. bi--plane magnified (n=36), mean 0.22 +/– 0,08
4. mono-plane magnified (n=47), mean 0.13 +/– 0,04
5. 3-D angiograms (n=22), mean 0,46 +/– 0,3

In 18 ap-lateral standard series the in-room display showed increased values exceeding 1 mSv/h. This led to an immediate improvement in positioning of the radiation protection devices. If these series are not considered in the calculation the mean value is 0.42 +/– of 0.2 mSv/h.

Conclusions: The RaySafe i2 system povides real time personal radiation exposure visualization. Increased dose rates are immediately visualized and can be reduced by improving the positioning of the radiation protection devices. A retrospective evaluation of radiation exposure to each series is possible. Therefore, a retrospective analysis when each exposure was present, becomes feasible.

0166
Feasibility Study of Using VOI Imaging During Neuro-Interventions

Q Zhang[1], RX Xu[1], B Wang[1], Q Sun[2], H Zhang[1], TH Shan[1], S Bauer[3], A Maier[3], J Beilner[2]

[1] Beijing PLA Military General Hospital Affiliated Bayi Brain Hospital, China. [2] Siemens Ltd., China, China. [3] Siemens AG, Germany.

Purpose: Three-dimensional (3D) scans with flat-detector angiographic systems are widely used for neuro-interventions by providing detailed vascular information for large scale of brain. However, high radiation dose is induced to patients and in fact, often only small regions are of clinical interest during interventions to check treatment progress. This work evaluates the feasibility of volume of interest (VOI) imaging with both lateral and axial X-ray beam collimation to generate high quality 3D images with reduced radiation dose.

Material and Methods: Full volume (FV) and prototype VOI scans (Artis Zeego, Siemens, Germany) were acquired for 10 patients with intracranial aneurysms and treated by endovascular coiling. For VOI scan, the C-arm was iso-centered around the coils and X-ray was collimated to 30 % of the FV size. For both scans, the C-arm rotated for 200 degrees and acquired 496 frames. FV and VOI images were reconstructed with conventional and prototype algorithms, respectively. Characteristic regions were defined in axial planes on lateral ventricle, caudate nucleus and coils. Mean gray values were extracted, normalized, and dose area products (DAP) were calculated.

Results: There was no significant visual difference between the resulting FV and VOI images. Quantitative deviations over all examined regions were 8.9%+/–3.6%.The DAP of VOI was found to be reduced 70% compared with FV imaging.

Conclusion: This study confirmed the feasibility of VOI imaging to achieve comparable image quality as FV imaging and reduce radiation dose. This technique could enable multiple 3D scans of the implanted device during the interventions, and thus, improve treatment efficacy.

0200
CBV Measurement During and Directly after Endovascular Stroke Treatment - Correlation with Follow-up CT

O Beuing[1], S Serowy[1], K Kyriakou[2], M Skalej[1]

[1] University Hospital Magdeburg, Germany.
[2] Siemens Healthcare, Forchheim, Germany.

Purpose: Endovascular treatment is an option in patients with major artery occlusion. In cases with long intervention times or partial recanalization, outcome may not be improved by continuing, while the complication rate increases. In this study it was evaluated, whether intra-procedural CBV-measurement might provide information about the treatment result already during the intervention.

Materials and Methods: CBV was measured with a flat panel C-arm CT (Artis Q, Siemens, Germany) with the following protocol: C-arm rotation before and after injection of 80ml Imeron 350 (Bracco, Germany); flow rate 4ml/s; CBV calculation with commercial software (syngo neuro PBV, Siemens, Germany). CBV-changes were evaluated with respect to size and changes compared to normal tissue. *Results:* were correlated with infarct size on follow-up CT.

Results: 22 separate areas with CBV-lesions in 13 patients were evaluated. 11 areas had a CBV of < 50% compared to normal tissue. CT showed infarctions in these areas with comparable extension (CBV- to infarct size ratio: 1,1). In 4/6 regions with a CBV of 50-100% no

infarction was visible on follow-up CT, whereas in 2 small basal ganglia infarctions developed. In 4/5 lesions with increased CBV, infarct size was considerably smaller than that with high CBV (CBV- to infarct size ratio: 1,74), one developed a small basal ganglia infarction.

Conclusion: Brain infarction developed in all areas with a CBV-decrease of more than 50%, as measured with C-arm CT. Thus, intra-procedural CBV-measurement might influence treatment decisions, e.g. continuation with the procedure or stent placement, in cases where no improvement of functional outcome is to be expected.

0201
C-arm CT Measurements of CBF and CBV: a Feasibility Study Using an Acute Ischemic Injury Model in Canines

K Royalty[1], C Strother[2], M Manhart[3], Y Deuerling-Zheng4, D Consigny[2], B Aagaard-Kienitz[2], D Niemann[2], A Ahmed[2], S Schafer[1]

[1] Siemens Medical Solutions USA, Inc., Hoffman Estates, IL, United States of America. [2] University of Wisconsin - Department of Radiology, Madison, WI, United States of America. [3] Friedrich-Alexander-Universität Erlangen-Nürnberg, 91058 Erlangen,, Germany. [4] Siemens AG, Healthcare Sector, Forchheim, Germany.

Purpose: To evaluate the feasibility of measuring CBF and CBV using a C-arm CT (ACT) acquisition in conjunction with a single contrast injection. Comparisons were made with perfusion CT (PCT) measurements in a canine stroke model.

Materials and Methods: Under an IACUC approved protocol, ischemic injuries were induced in 6 canines. 4 hours after stroke creation, PCT was acquired. Immediately following PCT, ACT perfusion scans were acquired using a flat detector C-arm system. Data was obtained from 7 consecutive bi-directional rotations (total scan duration of 28 s). Each rotation was reconstructed and interpolated in time to 1 volume per second. PCT and ACT data were processed into CBF and CBV maps using a standard deconvolution-based algorithm. Reader (n=3) analysis of the ACT and PCT perfusion maps was performed to compare lesion detection and CBF/CBV mismatch identification performance for ACT and PCT. Quantitative analysis was performed by placing symmetrical ROIs on co-registered PCT and ACT CBF and CBV maps.

Results: Reader results show strong observer agreement for identification of lesion location (Kappa > 0.8) for both modalities. A significant percentage agreement (>70%) was found for lesion detection and identification of mismatch between CBV and CBF maps. Quantitative ROI analysis showed a strong correlation between the PCT and ACT CBF and CBV ROI values (R2=0.85 and 0.68). ACT was found to overestimate both CBV and CBF measurements when compared to PCT values.

Conclusion: Qualitative and quantitative measurements of CBV and CBF with a high-speed ACT acquisition and a single intravenous injection of contrast agent are feasible.

0226
Puncture and Drainage of Supratentorial Hypertensive Cerebral Hemorrhage Assisted by Flat Detector Computed Tomography and Needle Guidance Software

ZG Yang[1], Y Hui[2], B Hong[1], JF Han[2], JC Chen[1], YB Fang[1], YH Zhang[1], JM Liu[1]

[1] Department of Neurosurgery, Changhai Hospital, Second Military Medical University, China. [2] Siemens Ltd. China Helathcare Sector AX Business Group, China.

Objective: To investigate the feasibility and safety of Flat Detector Computed Tomography (FDCT) based needle guidance software (syngo iGuide-Live, Siemens Healthcare, Germany) in the minimally invasive puncture and drainage of supratentorial hypertensive cerebral hemorrhage (HICH).

Methods: On 18 consecutive HICH patients, minimally invasive puncture and drainage procedures were performed. Before the puncture, a FDCT scan was acquired and data were automatically reconstructed in a dedicated workstation (syngo XWP, Siemens Healthcare, Germany). Upon the generated volume, the target areas such as an intracerebral hematoma and a planed burr hole were identified. The software enabled the surgeon to plan the needle path and visualize the path trajectory on live fluoro overlay.The surgeon advanced the needle according to the path provided by the software while puncture.

Results: All the procedures were successfully completed within 30 minutes on average. With support of needle guidance software, all drainage tubes were placed exactly in the targeted place aimed at. The average time the hematoma needed to decrease to less than 10ml was 3.4 ± 1.1 days. There were no major adverse events except one patient suffered from pneumonia. No patient died during the procedure or during the follow-up period. The Glasgow Coma Scale improved from of 10.2±1.7 before treatment to 12.3 ± 1.8 at discharge. The Glasgow Outcome Scale improved from 3.5 ± 0.8 at discharge to 3.9 ± 0.8 at one-month follow-up.

Conclusion: According to our outcomes, intra-procedural FDCT and integrated needle guidance software provided a feasible, convenient and safe way to perform the puncture and drainage of HICH patients.

0235
4D DSA: a New Tool for Visualizing Anatomical Details of AVMs and DAVFs

D Niemann[1], A Ahmed[1], B Aagaard-Kienitz[1], T Stuffert[2], A Doerfler[2], M Mawad[3], K Royalty[4], S Schafer[4], M Kowarschihk[5], C Mistretta[1], C Strother[1]

[1] UW Madison, United States of America. [2] University of Erlangen-Nuremberg, Germany. [3] Baylor College of Medicine, United States of America. [4] Siemens HealthCare AX, United States of America. [5] Siemens HealthCare AX, Germany.

Purpose: Evaluate the utility of time resolved 3D-DSA (4D-DSA) in evaluating AVMs and dAVFs.

Materials and Methods: With a 13 second rotation and a single IA injection, 3D-DSAs were obtained in a

series of AVMs and dAVFs. With prototype software 3D volumes were reconstructed to 304 time resolved volumes allowing vasculature to be viewed at any time in any view. 4D-DSAs were compared with conventional 2D series and 3D-DSAs by 3 observers. Our hypothesis was that the 4D DSAs provided at least as much anatomical information as would the combination of the 2D and 3D studies.

Results: Inflow, nidus/fistula filling and early venous drainage was best seen on the 4D-DSAs. Spatial resolution of the 4D studies was equivalent or superior to the conventional 3D-DSAs. In some instances, complete venous outflow could not be captured in the 4D studies. Intra-nidal aneurysms, venous obstructions, details of arterial filling and venous outflow were all best seen on the 4D-DSAs; these details were often not fully appreciated on the conventional studies.

Conclusion: 4D DSA was superior to conventional techniques for visualization of AVMs and dAVFs. It can enhance treatment planning and also reduce radiation exposure and contrast dose associated with evaluation of these lesions.

0241
Balloon Test Occlusion of the Internal Carotid Artery within the Angio Suite: Preliminary Results Utilizing Parametric Color Coding and Perfusion Imaging

E Ciceri, V Caldiera, L Caputi, R Cordella, G Farago'

IRCCS Neurological Institute C.Besta Milan, Italy.

Purpose: To test the feasibility, safety and usefulness of Syngo DynaCT utilizing Syngo iFlow and Cerebral Blood Volume (CBV) protocols, in the assessment of cerebral perfusion in patients undergoing Temporary Balloon test Occlusion (BTO) during DSA.

Materials and Methods: The study was approved by the Ethic Committee of our Institute. Seven patients (between 37/ 57 years, 5F/M), before surgery were studied with BTO. The DSA acquisitions were evaluated for venous delay with Syngo iFlow. At the end of the BTO, CBV was obtained.

Results: All patients were able to undergo BTO and perfusion acquisition. Using Syngo Dyna PBV Neuro on Leonardo station, colorimetric perfusion maps were obtained with quantitative data of CBV in 6 cerebral regions. In two cases we observed angiographic venous delay, confirmed by the iFlow data, and significant asymmetry between the two hemispheres with perfusion Syngo DynaCT. These patients were considered at risk of delayed stroke in case of ICA occlusion.

Conclusion: The ability to study CBV with angiography has been recently introduced. This method could represent a valuable complement to existing techniques, for the evaluation of the functional reserve of the brain during BTO. Our preliminary data are encouraging, but more extensive studies in a larger population are necessary to obtain statistically valuable results.

References

1 Struffert T, Deuerling-Zheng Y, Engelhorn T, et al. Monitoring of Balloon Test Occlusion of the Internal Carotid Artery by Parametric Color Coding and Perfusion Imaging Within the Angio Suite: First Results. Clin Neuroradiol. 2013.

0279
Volume-of-Interest 3D C-Arm CT for Assessing Device Position and Deployment Status in Endovascular Treatment of Complex Aneurysms

A Ahmed[1], Z Clark[1], B Aagaard-Kienitz[1], D Niemann[1], F Shaheen[1], K Royalty[2], S Schafer[2], C Strother[1]

[1] University of Wisconsin School of Medicine, United States of America. [2] Siemens Medical Solutions, United States of America.

Purpose: C-Arm DynaCT provides high spatial resolution images of devices in the angiography suite. It was our purpose to assess the image quality and impact on radiation by using an acquisition technique that limits exposure to a small volume of interest containing a particular device.

Methods and Materials: Twenty patients that underwent aneurysm treatment via stenting or stent assisted coiling were imaged post treatment using either full field of view (FOV) DynaCT, or a VOI DynaCT square collimated to 12% of conventional FOV size. Radiation dose-area-product (DAP) was recorded for each scan. Blinded readers were presented at random with conventional and VOI DynaCT images and assessed stent wall apposition, proximal and distal end visualization, relationship of stents to coils, as well as possible stent twisting and stretching.

Results: Stent wall apposition and end visualization were judged similar in conventional and VOI DynaCT. A slight improvement was seen in visualizing fine details such as stent struts and therefore assessing stent twisting and stretching for VOI DynaCT, attributable to the reduced x-ray scatter. Both methods faired similar for judging stent to coil relationship, a challenging task due to metal artifacts. Evaluation of radiation dose showed a reduction of DAP of ~85% from conventional to VOI DynaCT.

*Conclusion:*VOI imaging is a *Method:* well suited to assess device status, and resulted in a dramatic decrease in radiation dose. The low radiation burden can make VOI DynaCT suitable for repeat acquisition during surgical intervention and follow-up, allowing assessment of device status during critical steps in the intervention, such as stent and coil deployment.

0344
Comparison of High-Resolution X-ray and Micro-CT for Experimental Evaluation of Stent-Prototypes

A Keuler[1], C Taschner[1], MA Brockmann[2], H Boll[3], K Förster[4], A Herrmann-Frannk[5], M Lelgemann[5], M Schumacher[1]

[1] Dept. of Neuroradiology, University Hospital Freiburg, Germany. [2] Dep. of Diagnostic and Interventional Neuroradiology, University Hospital, Aachen, Germany. [3] Dep. of Neuroradiology, University Medical Centre Mannheim, University of Heidelberg, Mannheim, Germany. [4] Dep. of Cardiovascular Surgery, University Medical Centre Freiburg, Germany. [5] Dep. of Evidence-based Medicine, Medical Advisory Service of Social Health Insurance, Essen, Germany.

Objective: to compare mammography and micro-CT as high-resolution imaging tools regarding their sensitivity to detect changes of 3 tested prototypes of intracranial stents.

Method: Three types of preliminary stents for intracranial application (n=84) were implanted in various animal models (minipigs, domestic pigs and rabbits; n = 28 for each stent). After explantation we analysed the supplements using digital mammography and micro CT. The images were compared with respect to maintenance of material and form. In addition the different stents were compared to one another. Histology was made of everey recovered stent.

Results: The open-cell stents we tested revealed expansion of the stent cells up to total deformation of the struts in the majority of cases (57.1%) using micro-CT and less with mammography (42.3%). The form stable closed-cell stent revealed Kink stenoses 3 of 7 (42.9%) curved vascular courses in mammography as well as in micro-CT, detailed analyses could only be made from reconstructed micro-CT images. The flow diverter showed high-grade kink stenoses in two extremely curved vessels with both imaging methods. Individual strut breaks could be observed in all three stent types (micro-CT 6/84, 7.1%), in less cases with mammography (4/84, 4.8%). Histology confirmed changes of stent architecture and revealed resulting pathological changes of parent vessels.

Conclusion: Significant changes like expanded cell openings in the tested open-cell stent and relevant kink stenoses of the closed-cell and braided stents can be observed and assessed even in the 2-dimensional mammographic images. Finer changes in material and vessel lumen could only be reliably determined by micro-CT.

0389
Radiation Dose in Neuroangiography Using Image Noise Reduction Technology: a Population Study Based on 614 Patients

M Söderman[1], M Mauti[2], S Boon[2], A Omar[3], M Marteinsdóttir[3], T Andersson[1], S Holmin[1], B Hoornaert[2]

[1] Dept of Neuroradiology, Karolinska Hospital, Sweden. [2] Philips Healthcare, Best, Netherlands, The. [3] Dept of Hospital Physics, Karolinska Hospital, Sweden.

Introduction: The purpose of this study was to quantify the reduction in patient radiation dose by X-ray imaging technology using image noise reduction and system settings for neuroangiography, and to assess its impact on the working habits of the physician.

Methods: Radiation dose data from 190 neuroangiographies and 112 interventional neuroprocedures performed with state-of-the-art image processing and reference system settings were collected for the period January-June 2010. The system was then configured with extra image noise reduction algorithms and system settings, which enabled radiation dose-reduction without loss of image quality. Radiation dose data from 174 neuroangiographies and 138 interventional neuroprocedures were collected for the period January-June 2012. Procedures were classified as diagnostic or interventional. Patient radiation exposure was quantified using cumulative dose area product and cumulative air kerma. Impact on working habits of the physician was quantified using fluoroscopy time and number of digital subtraction angiography (DSA) images.

Results: The optimized system settings provided significant reduction in dose indicators versus reference system settings ($p<0.001$); from 124 Gy.cm^2 to 47 Gy.cm^2 and from 0.78 Gy to 0.27 Gy for neuroangiography, and from 328 Gy.cm^2 to 109 Gy.cm^2 and from 2.71 Gy to 0.89 Gy for interventional neuroradiology. Fluoroscopy and DSA was unaffected.

Conclusion: X-ray imaging technology using an image noise reduction algorithm and system settings provided approximately 60% radiation dose-reduction in neuroangiography and interventional neuroradiology, without affecting the working habits of the physician.

0418
Hybrid Operating System for Combined Surgical and Neuroendovascular Treatment

N Kuwayama, N Akioka

University of Toyama, Japan.

Zeego (Siemens, Germany) is the multi-axial C-arm interventional angio-machine and can be used in the operation room as the hybrid operating system for combined surgical and neuroendovascular treatment. It allows us to do not only simple percutaneous neurointerventions, but also surgical neuroendovascular treatment, like a craniotomy and catheter intervention or a neck dissection and catheter intervention. We treated 300 patients with cerebrovascular diseases using Zeego, and present representative cases treated using this kind of surgical catheter-interventional approach instead of the difficult percutaneous approach, including patients with dural AV fistulas and intracranial aneurysms.

0427
Added Value of the Raw Data Images from Three-Dimensional Rotational Angiography in Intracranial Arterial Dissections

YJ Lai[1], KH Kuo[1], LC Hsieh[1], CB Luo[2]

[1] Far Eastern Memorial Hospital, Taiwan
[2] Taipei Veterans General Hospital, Taiwan.

Purpose: To evaluate the added value of the raw data images from three-dimensional rotational angiography in the intracranial arterial dissections.

Material and Method: Eleven patients (5 men, 6 women; mean age: 47 years old) with symptomatic intracranial arterial dissections were included from November 2009 to June 2013. MR vessel wall imaging with dark-blooded T1 weighted and T2 weighted images was performed in eight patients. Diagnosis was established by the clinical history, intramural hematoma on MR images and conventional cerebral angiography. 3D angiograms were performed with the catheters placed in the extracranial target arteries using 25 mL 66% Iopamidol (370 mgI/mL) with the injection rate of 3.5 mL/sec. The raw data images from 3D angiography were reformatted in multiple planes and evaluated on the software osiriX.

Results: Two patients with SAH from dissecting aneu-

rysm, one patient had brain stem infarction due to dissection stenosis in the right vertebral artery with aneurysm formation, and eight patents with infarction resulting from arterial dissecting stenosis. On reformatted raw data images, intima flaps were found in eight patients (8/11, 72.3%) and eccentric/irregular vascular wall thickening were shown in three patients (3/11, 27.2%). In eight patients with intimal flaps identified on the raw data images, only two patients (2/11, 18%) demonstrated intimal flaps on projection cerebral angiography.

Conclusions: The intimal flap is a specific sign for arterial dissection, but less frequently recognized on projection angiographic images. With the advantage of reformatted raw data images, intima flaps could more likely be demonstrated.

0494
Assesment of Manual Compression Carotid Occlusion Test

R Rivera, JG Sordo, L Badilla, E Bravo, P Giacaman, R Riveros

Instituto de Neurocirugia Asenjo, Chile.

Purpose: Define the sensitivity, specificity and predictive values of manual compression carotid occlusion test, in the diagnosis of sufficiency of the circle of Willis.

Methodology: We analyzed retrospectively our patients studied between 2003 and 2013 to evaluate the sufficiency of circle of Willis with the manual compression carotid occlusion test compared with balloon occlusion test. We describe the data and report the sensitivity, specificity and predictive values of the manual compression carotid occlusion test.

Results: 27 patients were included. The median age was 58 years. The female to male ratio was 8:1. 25 patients had aneurysmal pathology and two patients had middle fossa meningiomas. Sensitivity of manual carotid compression was 57.69% and specificity 100%. The positive and negative predictive values were 100 and 8.3% respectively. There were no complications secondary to manual compression test.

Conclusions: The presence of the circle of Willis sufficiency by manual compression carotid has a high specificity and a high positive predictive value.

0503
Radial Access for Neuroangiography

R Rivera[1], P Giacaman[1], M Peldoza[2], JG Sordo[1], E Bravo[1], L Badilla[1], M Einersen[3]

[1] Instituto de Neurocirugia Asenjo, Chile. [2] Hospital Regional Hernan Henriquez, Temuco, Chile. [3] Hospital Guillermo Grantt Benavente, Chile.

Purpose: To present our experience in using radial access for neuroradiological studies.

Method: Prospective multicenter study of transradial cerebral angiography with standard technique between 02/2011 and 04/2013.

Results: 124 radial accesses were used from a total of 3114 angiograms in the study period. Mean age was 48 years (range 16-78), female predominance (65/124). The reasons for the examination were treated aneurysm control (44%), incidental aneurysms (25%), arteriovenous malformations and dural fistulas (22%). There were 4 cases of intracranial stenosis under antiplatelet therapy. Frustrated technique in 18/124 cases (15%), mainly due to inability to puncture and severe local vasospasm. Selective catheterization was achieved in vertebral arteries, internal carotid and external carotid and its branches. Outpatient management was performed in 102/124 cases (82%). Two patients had late radial artery thrombosis and one brachial artery non occlusive dissection without clinical consequences. Patients reported good acceptability of the technique.

Conclusion: The radial access was an excellent choice for cerebral angiography, particularly in control of endovascular therapy and antiplatelet cases. Allows outpatient studies, with reduced hospitalization costs and improving accessibility to the exam.